PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	Wind	Solar Thermal Trough	Solar Stirling	Solar PV
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100	1,100	1,100	1,100
Power System GHG (lbsCO2E/MWh)				
Transportation / Maintenance Emissions (lbsCO2E/MWh)				
Potential GHG Benefit (lbsCO2E/MWh)	1,100	1,100	1,100	1,100
Basis	GHG benefits results from power displaced from grid	GHG benefit results from power displaced from grid	GHG benefit results from power displaced from grid	GHG benefit results from power displaced from grid
Assumptions and Notes				Calculation does not consider the GHG benefit for converting CH4 to CO2 and the electrical efficiency of the equipment

Metrics

Grid Emission Rate (lbsCO2E/MWh) (CEC) 1,100

Note: The Scoping Plan used 963 lbs CO2E/MWh

PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	Solar Tower	Biomass Combustion	Landfill / Digester Gas-to-Energy
			Engine application
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100	1,100	1,100
Power System GHG (lbsCO2E/MWh)			672
Transportation / Maintenance Emissions (lbsCO2E/MWh)		70	
Potential GHG Benefit (lbsCO2E/MWh)	1,100	1,030	428
Basis	GHG benefit results from power displaced from grid	GHG benefits results from power displaced from grid minus GHG emissions from transporting biomass to energy plant	Base case is destruction of landfill gas with flare; GHG benefit combination of: 1) destruction efficiency of flare compared to energy system; 2) power displaced from grid
Assumptions and Notes		Biomass will emit same amount of CO2 whether it is allowed to decay in field, burned in field, or combusted at an energy plant; Transportation estimate based on 25 percent of emissions from 80 miles round-trip for heavy duty truck	Destruction efficiency for engines is 8 percent less than flares--therefore CH4 emissions will increase by 168 times (or 8% x 21) in energy systems as compared to flare

PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	Landfill / Digester Gas-to-Energy	Converting Biomass to Biodiesel	Biogas Injection into Natural Gas Pipeline
	Turbine and boiler		5% injection
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100	1,100	1,100
Power System GHG (lbsCO2E/MWh)		260	
Transportation / Maintenance Emissions (lbsCO2E/MWh)			
Potential GHG Benefit (lbsCO2E/MWh)	1,100	840	21-33
Basis	Base case is destruction of landfill gas with flare; GHG benefit is from power displaced from grid	GHG benefit results from power displaced from grid minus GHG emission from converting biomass to diesel	GHG benefit results from natural gas GHG being replaced by biogas
Assumptions and Notes	Destruction efficiency of turbines and boilers is the same as a flare	Power System GHG includes GHG emissions from converting biomass to biodiesel and electrical co-benefit	Biogas inclues lanfill or digester gas; converting biomass to biogas is not included; biogas/natural gas mixture burned in utility unit (range represents combined cycle plant versus grid average).

PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	**Geothermal**		**Small Hydropower and Conduit Hydropower**
	High CO2 emission factor	Low CO2 emission factor	
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100	1,100	1,100
Power System GHG (lbsCO2E/MWh)	260	50	
Transportation / Maintenance Emissions (lbsCO2E/MWh)			
Potential GHG Benefit (lbsCO2E/MWh)	840	1,050	1,100
Basis	GHG benefits results from power displaced from grid minus GHG emissions from geothermal plant		GHG benefits results from power displaced from grid
Assumptions and Notes	Geothermal power generation emission factor may vary due to geology and type of geothermal system used; dry steam geothermal may have almost zero emissions (need to investigate further); for the high CO2 emissions limit, the reference document does not specify what is included in the emission factor		

PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	Molten Carbonate Fuel Cell	Phosphoric Acid Fuel Cell	MSW Combustion or Conversion
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100	1,100	1,100
Power System GHG (lbsCO2E/MWh)			To be determined
Transportation / Maintenance Emissions (lbsCO2E/MWh)			
Potential GHG Benefit (lbsCO2E/MWh)	1,100	1,100	
Basis	GHG benefit results from power displaced from grid		GHG benefit results from power displaced from grid minus GHG emissions from the combustion or conversion of MSW
Assumptions and Notes	Fuel cells are using renewable fuel; calculation does not consider the GHG benefit for converting CH4 to CO2 and the electrical efficiency of the equipment		Assumed heat content of MSW 9,007,845 Btu/ton

PRELIMINARY DRAFT--FOR DISCUSSION PURPOSES ONLY
Attachment 2
GHG Benefit Determination for Renewable Sources

Technology	**Ocean Technology**
Avoided Grid GHG Emissions (lbsCO2E/MWh)	1,100
Power System GHG (lbsCO2E/MWh)	
Transportation / Maintenance Emissions (lbsCO2E/MWh)	
Potential GHG Benefit (lbsCO2E/MWh)	1,100
Basis	GHG benefit results from power displaced from grid
Assumptions and Notes	No commercial applications